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Rolling Core-less Microstars

Introduction:
Microstars are tiny stars generally less than 1/8" in diameter which are employed in special effects such as gerbs, matrix comets, very small shells, indoor sky-burst effects and other uses where small, brief colored sparks are desired. Because the stars are so small, rolling them using a central core of inert material would consume too much relative volume and drastically reduce the burn time of the star. Thus the most effective microstars should be made from solid composition with no core.

Because of the core-less requirement, the star roller would not seem to be an option for making microstars. However, upon dissecting some small round stars found in Chinese consumer products, it can be seen that they do have a process for rolling round stars without using cores.

When rolling round stars in a machine, small stars often form from bits of composition or other debris and grow into round stars without ever starting from a core. While this is undesirable when making normal stars, it would be nice to have the ability to create these small stars in a controlled manner instead of getting them as a byproduct. The process described in this article describes how to do just that, and gives a useful range of microstars with little or no dust product and only minimal amounts of oversized stars.

I have heard about people making microstars by screening damp composition into a star rolling bucket as it was rotating, but I never tried this due to the difficulty of holding a screen in one hand while pushing comp through it with the other hand. But with the large diameter and bottomless design of the NASCAR tire roller, it is possible to easily mount a screen in the center of the tire so that you don't have to hold it while working. The result is very easy way to make core-less microstars in sizes ranging from a grain of sand up to full sized round stars. If you are contemplating trying the NASCAR roller for yourself, here is yet another incentive!

Figure 1: NASCAR star roller modified for holding a central screen.

Setup:
Before this method can be used, the NASCAR star roller cabinet must be modified slightly from its original design. Figure 1 shows some wood blocks attached to the front and back panels, which give a flat surface for resting the screen. The construction plans for the circular cutout should really be modified so that the panel is flat in this area, thus eliminating the need for the blocks. If you have not built one of these yet and plan to, then be sure not to cut the full half circle, rather leave a flat spot so that these support blocks are not required.

Next you will need to build a screen or modify an existing screen so that it can rest between the blocks. The screen should be about 15 mesh, and window screen can be used also. Figure 2 shows the screen made specifically to sit on top of the two

Figure 2: A 15 mesh screen built to mount inside the NASCAR roller.

blocks. Note that the hold-down clamps on the sides fall short of the ends, which creates a notch to lock in place between the support blocks. This prevents the screen from sliding while you are pushing comp through it. The height of the screen walls really should not exceed 2 inches, otherwise it can be hard to place your palm flat on the screen while working.

The exact dimensions of this screen will depend on the tire you are using. I have since upgraded the tire I use to a Hoosier Radial GT, P275/60R15, which has a 27" Diameter and a 10" wide rolling trough. This has more volume for rolling than my original tire mentioned in the construction notes, and the inside surface is smoother between the ribs. It also has a wider opening measuring 7-3/4" across, which is ideal for using this screen technique. The screen can not exceed the width of the tire opening, thus the wider your tire opening is then the larger the screen area you will have to work with. The width of the screen should be as wide as you can make it without contacting the tire during use. If the tire does bump it during use, the screen will only center itself with no major disruptions. Allow for some slight wobble in the tire when designing the screen width.

Composition:

First let me say that not all star compositions will work well with this method. Particularly troublesome are the metallic compositions that have a lot of magnalium and parlon in them. These mixtures take an excessive amount of moisture to dampen to the correct working consistency, and even then they are still crumbly and hard to work with. The excessive moisture results in overly wet stars that stick together and clump into larger star clusters once screened into the tire. I'm not saying that it is impossible, it's just difficult and should not be tried until you get good at the easier compositions.

Figure 3: Over wetted composition with a clay like consistency will not work.

The ideal star formulas for this process will dampen to a clay like consistency when wet, such as most organic formulas and other formulas where all the ingredients are finely ground. The formulas that work well for making cut stars are the same ones that will work well for screening core-less round stars.

Because we are making microstars, it is also desirable to have the slowest burning color compositions possible. I like to use lance formulas for making these, with AP formulas producing the best results in both color purity as well as slower burn rate.

Figure 4: Clumped up mess resulting from over wetted composition (15% water).

Since AP is more difficult to get these days, this example uses Lancaster's KP based organic red lance formula with 5% dextin added as the binder:

Potassium Perchlorate	**70**
Strontium Carbonate	**18**
Red Gum	**12**
Dextrin	**5**

You will need to prepare about 1/3 the weight of the stars you are making as dry powder, with the remaining 2/3 being dampened with water. The amount of water used to dampen the powder is very critical for this process to work, and you will need to experiment to find the right amount when using other formulas. For the formula above, 13% is the magic number. Deviating by even 1% can cause bad results, although starting 1% too dry is easier to correct than starting 1% too wet. If the mixture can be squeezed into a ball and does not crumble when pushing your thumb into it, then it is too wet. Figure 3 shows the clay like consistency that 15% water will give you with the above formula, and Figure 4 shows the mess that results if you try to make stars with it. The tiny stars quickly stick to each other once they enter the tire, and small clumps turn into bigger clumps and then even bigger clumps. The composition should still be somewhat crumbly when gripped into a ball and then broken apart.

One general rule is that if you have a hard time pushing the composition through the screen because it is getting stuck in the screen, then it is too wet. If the stars develop a wet sheen while rolling, then they are too wet. If the powder easily falls through the screen and you get very fine microstars or just plain dust in the roller, then the composition is too dry. There is an exact point between these two conditions where the microstars will be produced without effort.

Once the proper moisture content has been determined (and recorded for future reference), you must keep a lid on the container during rolling or evaporation will throw off your fine tuned dampness.

Figure 5: Pushing damp composition through the screen and into the spinning tire.

Rolling:
With the screen in place as seen in Figure 5, start the roller and push a single handful of damp comp through the screen. Check the rolling characteristics of the tiny stars that should result in the tire. If they seem to be clumping together, add some dry star comp to see if they break up. Overly wet stars can not be separated in this way and you will have to scoop them out, add them back to the damp comp and let some water evaporate before continuing. If the stars seem very small or flowing like a pile of powder, spray with some water+20% alcohol to help them clump into stars and pick up dry dust.

At this point you can roll these cores as normal stars

Figure 6: Closeup of microstars ready for removal.

Figure 7: Microstar yield divided into three size ranges.

Figure 8: 31% passed through a 15 mesh screen.

by alternating between spraying and adding composition. Since microstars are small, you won't need to do much before removing the stars. The stars are not exactly round at this small stage, since many of them are clusters of several tiny stars stuck together. As the stars get larger they do start to round out, but a screening is necessary to remove some of the unwanted oversized and undersized stars if you want to keep rolling to make normal round stars.

It is better to only process one or two handfuls of composition through the screen before removing the stars, since clumping problems tend to increase when more stars are rolling at once. Doing small batches also limits damage if you mess up a batch by over wetting with the sprayer. Figure 6 shows a batch of microstars ready for removal, which are scooped out with a cut-off milk jug while the roller is running.

The moisture content of your damp powder will also determine the average size of your microstars. Powder on the dry side will produce smaller stars, while damper powder will product larger stars due to more clusters being formed.

The size breakdown of stars created from one kilo of the Lancaster red can be seen in Figure 7 through 10. A 15 mesh screen was used to filter out the smallest stars, which made up 31% of the overall batch weight. These very tiny stars would be good for indoor air burst effects or small matrix comets. If this were a crackle formula then these would make ideal dragon eggs.

The stars that didn't go through the 15 mesh were run through an 8 mesh (1/8" hardware screen) to produce the stars shown in Figure 9. This was the largest output, making up 55% of the total batch size. These stars would also be good for air bursts, small shells, matrix comets and gerbs.

A relatively small group of stars sat on the 8 mesh screen, shown in Figure 10. These could be used in larger diameter matrix comets, gerbs, cake shells, micro mines and small bore rocket headings.

From the 1000g of mixed star comp, only 3 g were lost as unusable dust. Compare this with the 7g that was lost in process from sticking to the roller, scoops, buckets, screens etc. Compared with other methods of making microstars, the dust production with this method is very low.

Conclusion:
This method of producing micro stars is the easiest I

Figure 9: 55% passed through 8 mesh and sat on 15 mesh.

Figure 10: 14% were larger than 8 mesh.

have yet seen, and allows you to convert all of a given batch of powder into a small range of star sizes rather than relying on byproducts from other processes. If you have trouble finding star cores for making regular stars, you may be able to use this process to start your normal sized stars after a bit of practice. This is an advanced rolling technique and you may not get ideal results the first time, but with practice it can be made to work well so don't give up.

One might be left wondering if this same method can be used to produce grained black powder for lift and break. While this would work, I believe the resulting powder would be weaker due to two factors: 1) there are no sharp edges on the grains as in corned powder, thus flame propagation will be slower due to lowered ignitability; 2) these grains are denser than those produced in a powder press for corning, so less surface area is exposed compared to an equal weight of corned powder. If your goal is to produce lift and break powder without using a press and corning machine, then screened rough powder made as described here is a better and faster way to go about it.

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